

Claims

1. A cylinder liner for insert casting, having a plurality of projections each having a constriction on an outer circumferential surface, the cylinder liner is characterized by satisfying the following requirements (i) to (iv):

(i) the height of projections is in a range between 0.5 mm and 1.0 mm, inclusive;

(ii) the number of the projections is in a range between 5 and 60, inclusive, per cm^2 on the outer circumferential surface;

(iii) a ratio S1 of area of a region that is encircled by a contour line of a height of 0.4 mm is no less than 10% in a contour diagram of the projections, the diagram being obtained through measurement of the outer circumferential surface along the height direction of the projections with a three-dimensional laser measuring device; and

(iv) a ratio S2 of area of a region that is encircled by a contour line of a height of 0.2 mm is no more than 55% in a contour diagram of the projections, the diagram being obtained through measurement of the outer circumferential surface along the height direction of the projections with a three-dimensional laser measuring device.

2. A cylinder liner for insert casting, having a plurality of projections each with a constriction on an outer circumferential surface, the cylinder liner is characterized by satisfying the following requirements (i) to (iv):

(i) the height of projections is in a range between 0.5 mm and 1.0 mm, inclusive;

(ii) the number of the projections is in a range between 5 and 60, inclusive, per cm^2 on the outer circumferential surface;

(iii) a ratio S1 of area of a region that is encircled by a contour line of a height of 0.4 mm is in a range between 10% and 50%, inclusive, in a contour diagram of the projections, the diagram being obtained through measurement of the outer circumferential surface along the height direction of the projections with a three-dimensional laser measuring device; and

(iv) a ratio S2 of area of a region that is encircled by a contour line of a height of 0.2 mm is in a range between 20% and 55%, inclusive, in a contour diagram of the projections, the diagram being obtained through measurement of the outer circumferential surface along the height direction of the projections with a three-dimensional laser measuring device.

3. The cylinder liner for insert casting according to claim 1 or 2, characterized in that:

regions each encircled by a contour line of the height of 0.4 mm are independent from each other in the contour diagram, and the area of regions each encircled by a contour line of the height of 0.4 mm is in a range between 0.2 mm² and 3.0 mm², inclusive.

4. A method for manufacturing a cylinder liner for insert casting, in which method centrifugal casting is used, characterized in that:

a suspension is prepared which contains 8 to 30% by mass of refractory material, 2 to 10% by mass of binder, and 60 to 90% by mass of water; surfactant of which the loading is greater than 0.005% by mass and no more than 0.1% by mass is added to the suspension to form mold wash; the mold wash is applied to an inner circumferential surface of a mold that has been heated and is being rotated, thereby forming a mold wash layer; a recess is formed through action of the surfactant to each of bubbles in the mold wash layer; the bottom of each

recess reaches the inner circumferential surface of the mold, so that a recess with a constriction is formed in the mold wash layer; thereafter, molten metal of cast iron is poured into the mold in which the mold wash has been dried; and consequently, a cylinder liner that has projections each having a constriction, the projections being formed on the outer circumferential surface, is manufactured.

5. A method for manufacturing a cylinder liner for insert casting, in which method centrifugal casting is used, the method being characterized in that cylinder liner is manufactured through the following steps (a) to (d):

(a) preparing a suspension, which contains 8 to 30% by mass of refractory material, 2 to 10% by mass of binder, and 60 to 90% by mass of water;

(b) forming a mold wash by adding surfactant to the suspension, the loading of the surfactant satisfying an inequality in which $0.005\% \text{ by mass} < \text{loading} \leq 0.1\% \text{ by mass}$;

(c) applying the mold wash to an inner circumferential surface of a mold that has been heated to a predetermined temperature and that is being rotated, thereby forming a mold wash layer; and

(d) pouring molten metal of cast iron into the rotating mold in which the mold wash has been dried, thereby manufacturing a cylinder liner that has projections each having a constriction, the projections being formed on the outer circumferential surface.

6. A method for manufacturing a cylinder liner for insert casting, in which method centrifugal casting is used, the method being characterized in that the cylinder liner is manufactured through the following steps (a) to (e):

(a) preparing a suspension that contains 8 to 30% by mass of refractory material, 2 to 10% by mass of binder, and

60 to 90% by mass of water;

(b) forming a mold wash by adding surfactant to the suspension, the loading of the surfactant satisfying an inequality in which $0.005\% \text{ by mass} < \text{loading} \leq 0.1\% \text{ by mass}$;

5 (c) applying the mold wash to an inner circumferential surface of a mold that has been heated to a predetermined temperature and that is being rotated, thereby forming a mold wash layer;

10 (d) forming recesses through action of the surfactant with bubbles in the mold wash layer, permitting the bottom of each recess to reach the inner circumferential surface of the mold, and forming recesses each having a constriction in the mold wash layer; and

15 (e) pouring molten metal of cast iron into the mold after the mold wash has been dried and while the mold is being rotated, thereby manufacturing a cylinder liner that has projections each having a constriction, the projections being formed on the outer circumferential surface.

20 7. The method for manufacturing a cylinder liner for insert casing according to any one of claims 4 to 6, characterized in that:

average particle size of the refractory material is in a range between 0.02 and 0.1 mm, inclusive.

25 8. The method for manufacturing a cylinder liner for insert casing according to any one of claims 4 to 7, characterized in that:

30 the thickness of the mold wash layer is in a range between 0.5 mm and 1.1 mm, inclusive.